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the AEROVOX Research Worker

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Vol. 4 February 1931 A. R. SATULLO No. 2

The Measurement of Capacity and Leakage of Electrolytic Condensers

By the Engineering Department, Aerovox Wireless Corporation

THERE are a number of methods which can be used to measure accurately, the capacity, leakage and power factor characteristics of electrolytic condensers but such methods involve the use of apparatus not usually available to general experimenters and service men.

For all practical purposes, very good results in measuring capacity can be obtained by using a standard 110-volt microfarad-meter of the required range on electrolytic condensers having peak voltage ratings of 400 volts or more. Before testing for capacity, the rated D.C. voltage of the condenser should be applied for five minutes. If the condenser has been off voltage for several months it may be necessary to leave it on voltage for longer periods up to a half hour before measuring the capacity or leakage.

One of the simplest methods of measuring both the capacity and leakage of electrolytic condensers rated at 300 volts D.C. peak or higher makes use of the circuit shown in Fig. 1. This test circuit can be constructed at low cost of material usually available in most service laboratories.

The most important point to remember in connection with the use of this test circuit is to connect the electrolytic condenser into the circuit with the proper polarity with respect to the polarity of the voltage source "B".

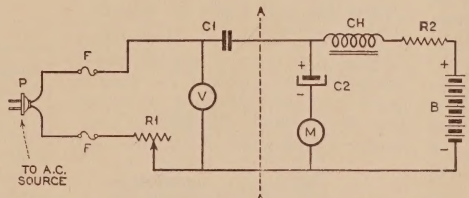

Fig. 1

Parts Used in Test Circuit

B—a source of pure D.C. of 300 to 400 volts (batteries or well-filtered power supply unit. Exact voltage not important).
C1—Aerovox Type 602, 4 mfd., 600-volt D.C. working voltage wax paper condenser. (Only a wax paper type condenser should be used in this position).
C2—Electrolytic condenser under test (polarity must be connected as indicated with respect to the polarity of the 300-volt D.C. supply.
CH—30 to 50 Henry choke coil such as is generally used in standard power supply units.
F—1-amp. fuses.
M—O-250 A.C. Milliammeter. Weston Model 517, Jewell Pattern 74 or equivalent.
P—Standard 2-prong plug.
R1—400-ohm rheostat capable of carrying at least 200 milliamperes, Carter Type SW-400 or equivalent.
R2—Aerovox Type 996, 2,000-ohm Pyrohm Resistor, rated at 100 watts.
V—O-150 A.C. Voltmeter. Weston Model 517, Jewell Pattern 74 or equivalent.

Since the difference in D.C. current leakage with different applied voltages within wide limits is very small, the exact voltage of the voltage source "B" is not important as long as it is somewhat lower than the maximum peak voltage rating of the condenser and high enough to roughly approximate the conditions of operation. It must be, however, higher than the peak voltage of the A.C. voltage source.

The capacity at "C1" must be 4 mfd. since the current readings given in the chart which follows are based on the use of that value of capacity at "C1".

In every other way the circuit is foolproof, the milliammeter being protected, even in the case of a short in the electrolytic condenser, by the protective resistor "R2". The condenser "C1" limits the maximum A.C. current which can flow in the A.C. circuit.

To operate the test circuit, keep plug "P" out of the 110V. A.C. receptacle and connect the electrolytic condenser to be tested in the position shown. The initial leakage will be rather high for the first few minutes,

(Continued on page 8)

AEROVOX PRODUCTS ARE BUILT BETTER

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Hi-Farad DRY Electrolytic Condensers

THE wide popularity enjoyed by Aerovox Hi-Harad Dry Electrolytic Condensers can be attributed to one outstanding quality — MERIT.

The issuance of Patent No. 1,789,949 covering the features of construction of the Aerovox Hi-Farad Dry Electrolytic Condenser to the Aerovox Wireless Corporation on January 20, 1931 is the culmination of years of intensive research work and exhaustive laboratory and field tests in the development of the most outstanding electrolytic condenser in the field today.

The most important features of the Hi-Farad condenser are given in the accompanying article. More detailed information on the characteristics of this truly remarkable condenser are contained in a booklet "The Aerovox Hi-Farad Dry Electrolytic Condenser" a copy of which will be sent free of charge on request.

A Proved Product

The Aerovox Hi-Farad Condenser is not an experimental product. Its MERIT has been proved in exhaustive laboratory and field tests and in actual use under every conceivable operating condition. It has proved its SUPERIORITY in open competition with every other condenser in the field.

Dry Characteristics

The Aerovox Hi-Farad Dry Electrolytic Condenser banishes forever the danger and disadvantages resulting from the use of liquid in a radio set.

The DRY feature of Hi-Farad

condensers leaves them unaffected by the jarring, vibration or tilting conditions met with in transportation or in operation on automobiles, trains, airplanes, boats and portable installations.

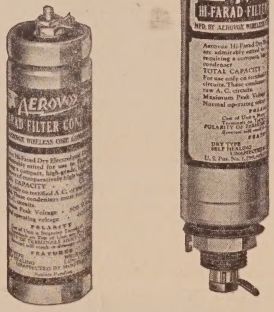
Why Build Water Into a Radio Set when a thoroughly satisfactory DRY electrolytic condenser is available?

Low Cost

When figured on the basis of cost per microfarad per volt rating, the Aerovox Hi-Farad Dry Electrolytic Condenser is the most economical condenser in the field. Its extremely low cost eliminates all necessity for skimping on filter and bypass circuits.

Compact and Light in Weight

Aerovox Hi-Farad Dry Electrolytic Condensers are the most compact and lightest in weight per microfarad per volt rating of any dry or wet electrolytic condenser in the field. The economy



of space and weight, especially in the case of midget sets, results in worthwhile savings in the construction and shipping cost of receivers in which they are used.

High Filtering Efficiency

The filtering action of Aerovox Hi-Farad Dry Electrolytic Condensers is equivalent to that of paper condensers of equal capacity. This remarkable feature is due to the construction characteristics and the improved electrolyte employed which produce a condenser of minimum dielectric losses, low leakage and low equivalent series resistance.

Because of the low cost, compact design and extremely low weight per microfarad of Aerovox Hi-Farad Dry Electrolytic Con-

densers, it is possible to use greater capacity in any given filtering application without increase in cost, bulk or weight thereby providing greater filtering action, with resultant decrease in hum and appreciable increase in tone quality.

High Voltage Characteristics

Because of the special characteristics of the electrolyte used in Aerovox Hi-Farad Dry Electrolytic Condensers, they can be made in ratings up to 500 volts D. C. peak, a rating higher than any other electrolytic condenser employing single sections (no series connections). Higher voltage rating can be obtained by connecting two or more units in series.

Safe, Surge-Proof, Self-Healing

The Aerovox Hi-Farad Dry Electrolytic Condenser is the safest condenser on the market. Because of its self-healing and "Safety Valve" characteristics, the presence of surges or transient overvoltage conditions do not affect the operation or life of Hi-Farad condensers.

As soon as the surge or transient overload condition passes, the dielectric film automatically heals up instantly and the condenser is immediately restored to full operating efficiency.

Efficient Regulator Action

The comparatively high leakage current drawn by electrolytic

Are Taking the Country by Storm

condensers, during the first few seconds after the power switch is turned on, or when excessive volt-

ages are applied, limits the peak "no-load" voltages applied in the receiver circuits during the interval that the tubes are heating up. This feature prevents the application of unduly high peak voltages in the circuits, thus protecting bypass condensers and other elements against excessive voltages.

Long and Efficient Operating Life

Hi-Farad condensers have been on life test racks for 24 hours a day over a period of over 10,000 hours which is equivalent to approximately ten years of normal service at three hours a day. Careful examination and exhaustive tests after such service show no signs of weakening the unit in any way, proving that the actual life of these condensers is many times the useful life of any set in which they may be used.

It is interesting to note that the dielectric film of Aerovox Hi-Farad Dry Electrolytic Condensers actually improves with use, since the longer they are connected across a source of voltage, the tougher the film becomes, thus improving the dielectric and leakage properties of the film.

The effect of shelf life on capacity and leakage is neglible and may be disregarded altogether, since the capacity and leakage become normal shortly after the condenser is put in operation again.

The self-healing, surge-proof characteristics of the condensers insure long life and safety against transient overload conditions.

The use of aluminum throughout with a special electrolyte which does not attack aluminum, eliminates all possibility of harmful galvanic action and corrosion of the elements. The result is long life and freedom from servicing troubles.

Stable Under All Conditions of Operation

The characteristics of Aerovox Hi-Farad Dry Electrolytic Condensers remain practically constant under all normal and somewhat abnormal operating conditions. They will continue to function efficiently at temperatures as

low as 40 degrees below zero F. and may be operated at temperatures as high as 135 degrees F. when used at peak voltages not exceeding 400 volts D.C. When used at higher voltages up to 500 volts D.C. peak, the condenser should not be operated at higher than 120 degrees F. for best results. Hi-Farad condensers have been operated at temperatures as high as 170 degrees F. for test purposes although such excessive operating temperatures are not recommended for normal use.

Exhaustive tests of capacity, leakage and power factor covering periods of 2,500 hours and more of Hi-Farad condensers at the output of a rectifier show only a slight increase in capacity from 8 to 8.1 mfd., and a definite improvement in leakage and power factor characteristics.

They are unaffected by climatic or atmospheric conditions.

Low Leakage Current

The leakage current of all types of electrolytic condensers as compared to wax paper condensers is naturally higher, due to lower insulation resistance of the dielectric. Within very wide limits however, this leakage current has very little effect on the relative filtering efficiency of the two types of condensers, microfarad per microfarad of capacity.

Leakage current characteristics of electrolytic condensers of any manufacturer will vary widely from .02 to .5 milliamperes per microfarad after being connected to a source of rated voltage for five minutes. Leakage current characteristics should never be taken until after the condenser is connected across the rated voltage for at least five minutes.

The leakage current of most electrolytic condensers will fall in the range of from .05 to .1 milliampere per microfarad at rated voltage after being connected across voltage for five minutes.

After long periods of idleness the leakage current may be expected to be higher for the first few seconds after it is connected across the voltage source. After five minutes however, the leakage will drop down to normal and remain at that value during normal continuous and intermittent operation. The leakage current characteristics of Aerovox Hi-Farad condensers improve (become lower) with use. After constant use, the leakage current drops to a much lower value than that of wet electrolytic condensers.

(Cont. on p. 7, bottom of col. 1)

Universal Mounting Rings for Hi-Farad Condensers

An Interesting Catechism on Aerovox

THE questions listed in this article are taken from written and verbal inquiries made by radio engineers, purchasing agents, and experimenters regarding the operating characteristics of Aerovox Hi-Farad Dry Electrolytic Condensers.

We take pleasure in answering every question with data based on proved engineering principles and exhaustive laboratory and field tests. It is obviously impossible in the limited space available to go into great detail on any subjects requiring involved technical discussions. In such cases, therefore, a general statement of the principles involved is given. We shall be glad to discuss at length, with interested engineers, purchasing agents and manufacturing executives, any phase of the subject on which further information is desired and to substantiate any statements we make in our answers with definite, incontrovertible proof.

QUESTION NO. 1

Is there any possibility of film formation on the cathode plate or can of the Hi-Farad Electrolytic Condenser?

ANSWER.

It is impossible for any film to form on the can of the Aerovox Hi-Farad Dry Electrolytic Condenser. In the Hi-Farad condenser the can merely serves as a protective container, and a means of mounting and making an electrical connection to the cathode plate which is electrically connected to the can. The can is not in contact with any electrolyte as is the case with wet electrolytic condensers. As far as the possibility of film formation on the aluminum cathode plate of the Hi-Farad condenser is concerned, this is also impossible; first, because a special grade of aluminum, selected because of its non-filming properties, is used for the cathode, and secondly, because the electrolyte used in the Aerovox Hi-Farad Dry Electrolytic Condenser does not attack the aluminum plate.

This has been definitely proved by microscopic examination and electrical and chemical tests made on cathode plates and cans of Hi-Farad condensers which were disassembled and tested after being in operation for periods of over a year under conditions closely approximating actual operating conditions.

One of the best indirect proofs that no film is formed on the cathode of Hi-Farad condensers is the fact that capacity measurements made on Hi-Farad condensers after long periods of continuous and intermittent operation show no diminution in capacity. If film were to form, a

Showing mounting ring used to mount a condenser partly above and partly below subpanel.

very noticeable decrease in capacity would be expected since film formation on both positive and negative plates would be equivalent to increasing the effective thickness of the dielectric, thereby decreasing the effective capacity of the unit.

QUESTION NO. 2

Are there any advantages in addition to lower cost for the use of aluminum as the cathode and can of Hi-Farad Dry Elecrolytic Condensers?

ANSWER.

Aluminum has many advantages in addition to lower cost, although that advantage is important in that it makes it possible to spend more in the construction of the other elements without increasing the total cost of the unit.

In the first place, the use of a single metal throughout the unit eliminates any possibility of harmful galvanic action which would tend to cause corrosion of the condenser parts, thus producing noise in a receiver and also shortening the useful life of the condenser. In the second place, the use of aluminum for the can, thereby matching the other units of the receiver, eliminates the extra cost of plating the can to match the other units of the receiver. In the third place, the use of aluminum, with an electrolyte which does not attack it, eliminates the possibility of introducing impurities in the electrolyte through the action of the electrolyte on the cathode.

QUESTION NO. 3

Isn't the lower initial leakage of the wet electrolytic condenser as against the comparatively higher initial leakage current of the dry electrolytic condenser an advantage in favor of the wet electrolytic type of condenser?

ANSWER.

The initial leakage during the first few minutes that voltage is applied across a dry electrolytic condenser is higher than is the case with wet electrolytic condensers. This apparent advantage, however, has no real significance since the comparatively higher leakage current exists only when the condenser has been off voltage (not in operation) for periods of several months, a condition that happens only a few times during the life of a set, and then only lasts for a very short time.

As far as the user of the receiver is concerned, the receiver operates normally and at full volume as soon as the receiver is turned on and the tubes heat up. The slight additional leakage and temperature rise during the first few minutes that the receiver is turned on after months out of operation has no measurable bad effects on the condenser or its associated equipment. On the other hand, once in operation, the leakage of the dry electrolytic condenser drops to a lower value than that of the wet electrolytic

Hi-Farad DRY Electrolytic Condensers

condenser, a factor in favor of the dry electrolytic condenser.

The difference in intial leakage current of the two types of condensers is a "talking point" and nothing more. Similar "talking points" have been advanced in the vacuum tube field to deceive those who are not well posted on their engineering. Engineers know that the plate current drain of a vacuum tube is not a definite measure of the efficiency of a tube, yet to this day "gyps" do a land-office business on poor tubes by making comparative "tests" which show that the tubes they are pushing draw higher plate currents than standard tubes.

QUESTION NO. 4

Isn't there a danger that the moisture contained in the "paste" used as the electrolyte in dry electrolytic condensers will cause the condenser to become inoperative in a comparatively short time?

ANSWER.

To begin with the electrolyte used in the Hi-Farad Dry Electrolytic condenser is not a "paste." The electrolyte consists of a liquid compound which is thoroughly absorbed by the absorbent separator used between the anode and cathode plates, bringing the electrolyte into intimate contact with the electrodes. Since the absorbent material effectively holds the electrolyte in place, there is no danger of the electrolyte spilling out, so that the condenser is essentially "dry" although the absorbed electrolyte is of course liquid. In the next place, the electrolyte used in Hi-Farad Dry Electrolytic condensers is primarily a non-aqueous composition and will not evaporate to any measurable extent under the normal and abnormal conditions met with in practice. In this respect the electrolyte is much more stable than the preponderantly aqueous solutions used in other electrolytic condensers.

In the third place, the electrolyte used in Hi-Farad Dry Electrolytic Condensers, being hygroscopic, absorbs water from the moisture in the atmosphere to counteract any slight loss due to evaporation, electrolysis and any other cause.

QUESTION NO. 5

Is any compound such as pitch used to seal the condenser element of Hi-Farad condensers to prevent loss of moisture?

ANSWER.

No sealing compound is used in Aerovox Hi-Farad Dry Electrolytic Condensers and none is necessary because the character-

In this method of inverted mounting, the cover and terminals project through the bottom of the subpanel.

istics of the special electrolyte used are such that it is held by the absorbent material without danger of loss. The elimination of the necessity for the use of such sealing materials improves the characteristics of Aerovox Hi-Farad Dry Electrolytic Condensers by providing better heat dissipating properties, lower leakage current characteristics and eliminating all possible chance of contaminating the electrolyte or damaging the dielectric film.

Being devoid of sealing compounds, the Hi-Farad Dry Electrolytic Condenser is more compact than units which require the use of such sealing compounds.

QUESTION NO. 6

Does electrolysis, due to the passage of leakage current, cause decomposition of the water used in the electrolyte employed in the Hi-Farad condenser and affect the operation of the condenser?

ANSWER.

In accordance with Faraday's Law the rapidity of decomposition of an electrolyte depends largely on the magnitude of the current flowing through the electrolyte. Since the leakage current flowing in an Aerovox Hi-Farad Dry Electrolytic Condenser is so small that it is measured in micro-amperes, it would take many years of use to bring about any appreciable chemical decomposition.

Further, because of the fact that no sealing compounds are used and the highly hygroscopic character of the electrolyte, the electrolyte absorbs water from the moisture in the atmosphere to counteract the extremely minute loss due to electrolysis.

QUESTION NO. 7

Where a condenser is used directly across the output of a rectifier tube, the A.C. current through the condenser will be approximately equal to the D.C. drain of the load connected across the filter circuit. In the case of a receiver which draws 100 *milliamperes, the current through the first condenser of the filter (connected across the output of the rectifier) will be approximately* 100 *milliamperes A.C. Will not this comparatively high current cause appreciable electrolysis? Also will not the current alternate so that during the part of the cycle when the condenser is discharging current will flow in the opposite direction to the leakage current and tend to form a film on the cathode of the condenser?*

ANSWER.

It is erroneous to compute the rate of decomposition of an electrolyte on the basis of the alternating component, since for all practical purposes no electrolysis of the electrolyte takes place at the frequencies present in power supply and audio circuits. The migration velocity of the hydrodrogen ion, the fastest of all ions, in a very fluid solution is of the order of .0032 centimeters per second. At 120 cycles per second, the fundamental frequency present in a full-wave power sup-

therefore travel only .000014 centimeters (during half a cycle) before the current reversed.

With the viscosity of the electrolyte used in Aerovox Hi-Farad condensers, the velocity of the ions is reduced even more, so that under such conditions, electrolysis, due to the passage of the alternating current component through the condenser does not occur.

As far as the formation of film on the cathode of the Hi-Farad condenser is concerned, the assumption that the reversal of current through the condenser when the condenser discharges will cause any film formation on the cathode is absolutely erroneous.

The voltage of the A. C. component is only a fraction of the total voltage applied across the first filter condenser. The effective voltage applied across the condenser at any instant is always strongly polarized (the condenser is never completely discharged), keeping the anode of the condenser positive and the cathode negative.

Under such circumstances, with the type of electrolyte and grade of aluminum used as the cathode in the Hi-Farad Dry Electrolytic Condenser, no noticeable film formation has ever appeared on the cathode plates of Hi-Farad condensers, even over long periods of operation under heavy load conditions.

As has already been pointed out in the answer to Question No. 1, careful examination and tests reveal no film formation on the cathode of Hi-Farad condensers.

QUESTION NO. 8

Have you made any tests with Hi-Farad Dry Electrolytic Condensers connected directly across the rectifier with actual full load applied across the output of the filter under conditions of continuous and intermittent operation?

ANSWER.

Aerovox Hi-Farad Dry Electrolytic Condensers have been subjected to numerous life tests

Aerovox Patent on DRY Electrolytic Condenser Granted

The Aerovox Wireless Corporation takes pleasure in announcing that it has been granted Patent No. 1,789,949, dated Jan. 20, 1931 covering the design and construction features of its DRY electrolytic condensers.

The features of the Aerovox Hi-Farad DRY Electrolytic Condensers are thoroughly protected by the claims allowed in this patent.

ply unit, the hydrogen ion would under normal and accelerated operating conditions. These tests have included the operation of the condensers across the output of the rectifier with an applied load draining 120 milliamperes across the output of the filter. Such experiments have been made covering periods of 2,500 hours and more.

Capacity, leakage and power factor measurements were made of the condensers before they were put on test and at regular intervals during the period of the tests.

The measurements made at regular intervals showed a slight increase in capacity, from 8 mfds. at the start to 8.1 mfds. at the finish. The leakage current dropped from 1 milliampere per 8 mfd. section at the start down to .175 milliampere at the finish. The power factor decreased from a value of 8 per cent at the start to 6 per cent at the finish. These results indicate a marked improvement in the charcteristics of the dielectric film of Aerovox Hi-Farad Dry Electrolytic Condensers with use. Accurate weighing at the beginning and at the end of the tests showed no appreciable loss in weight, proving conclusively that no loss of electrolyte results during the course of their operation. Aerovox Hi-Farad Dry Electrolytic Condensers may truly be said to IMPROVE WITH USE.

QUESTION NO. 9

Cannot the relative efficiencies of dry and wet electrolytic condensers be compared to the relative efficiencies of dry and wet batteries? It is well known that dry batteries do not last as long as wet watteries, even when the dry batteries are not in use.

ANSWER.

Batteries and condensers are entirely different electrical units. The only similarity is that wet batteries and wet electrolytic condensers employ a mass of liquid as the electrolyte, whereas in the dry batteries and dry electrolytic condensers, the liquid electrolyte is absorbed in an inert medium so that they may be considered "dry" for all practical purposes since the electrolyte will not splash around or spill out.

In a battery, electrical energy is taken from the cell as the result of a chemical or voltaic action in the cell. In a condenser the only energy given up by the condenser on discharge is the energy put into the condenser when it is charged.

The electrolyte used in the Hi-Farad Dry Electrolytic Condenser does not attack aluminum and since both electrodes are made of aluminum there is no voltaic action which would tend to produce a chemical action resulting in the decomposition of the elements of the cell and the production of electrical currents.

In some types of electrolytic condensers which employ aluminum as the anode and another metal as the cathode and employ an electrolyte which attacks such elements, all the conditions for voltaic action of a greater or lesser degree are present, and may result in corrosion and the generation of currents which may affect their operation over a long period of time.

It must also be remembered that whereas the current flowing through the electrolyte of any battery is usually rather high, rising to as high as several hundred amperes at times in heavy duty batteries and tending to pro-

duce decomposition of the electrolyte, the current flowing through an electrolytic condenser is very small and causes no appreciable action of this kind, as has already been explained in the answer to Questioon No. 6.

QUESTION NO. 10

If the characteristics of your dry electrolytic condensers are so much better than those of wet electrolytic condensers, why is it that so many manufacurers continue to make the wet type electrolytic condensers.

ANSWER.

The history of invention and scientific development is filled with instances of men and concerns who have failed to make advances in an art and were satisfied to "let well enough alone."

Aerovox Hi-Farad Dry Electrolytic Condensers are covered by strong patent claims contained in Patent No. 1,789,949 and other pending patents. Similar condensers, containing the features incorporated in Aerovox Hi-Farad Dry Electrolytic Condensers cannot be made by any other manufacturer.

We hope that the accurate, straightforward answers given to these questions will also serve to nullify the malicious whispering campaign propaganda instigated by unscrupulous competitors, who (prevented from making a similar product because of the patent protection obtained by the Aerovox Wireless Corporation on the construction features of its Hi-Farad Dry Electrolytic condensers) have adopted a "Fox and the 'Sour' Grapes" attitude toward this truly remarkable condenser.

Hi-Farad DRY Electrolytic Condensers Are Taking the Country by Storm

(Continued from page 3)

Attractive Appearance

The natural aluminum finish and smooth drawn features of Aerovox Hi-Farad Dry Electrolytic Condensers match perfectly the finish of the other elements of most receiver, amplifier and power supply assemblies thus eliminating any necessity for costly plating and finishing operations.

Constant Improvement is Aerovox Policy

It is the policy of the Aerovox Wireless Corporation to constantly improve its products or change its prices whenever improved processes, better quality or lower priced raw materials and manufacturing economies make such improvements or changes in price advisable.

For the good of the trade therefore, the Aerovox Wireless Corporation reserves the right to change, without notice, its manufacturing specifications and prices on standard products for general sale.

On parts made to manufacturers' specifications however, no changes will ever be made except with due notice to and authorization from the customer.

The policy of the Aerovox Wireless Corporation will always be to provide the best possible merchandise at the lowest possible price.

Simple, Universal Mounting Feature

The Hi-Farad condensers can be used with perfect safety in any position — UPRIGHT, HORIZONTAL, INVERTED OR AT ANY OTHER ANGLE.

The simple, inexpensive mounting ring can be used to mount the condenser either upright or inverted with any proportion of the condenser above or below the plane of the subpanel on which it is mounted.

Wet electrolytic condensers can only be used in the position for which they are designed — upright if the condenser was made for upright mounting and inverted if the condenser was made for inverted mounting. No wet electrolytic condenser can be mounted horizontally since mechanical considerations make such mounting impossible.

The universal mounting feature makes it possible to change chassis design without delay and without scrapping condensers already on hand.

Capacity and Voltage Ratings

Aerovox Hi-Farad Dry Electrolytic Condensers are available in a wide variety of single and combination units, capacity values and voltage ratings. Manufacturers and experimenters are not limited to the use of a few capacity values or voltage ratings.

Hi-Farad condensers can be furnished in capacities of one microfarad and up and in voltage ratings of from 12 to 500 volts D.C. peak for all filtering and bypassing applications.

This feature makes it possible to effect worthwhile savings in addition to providing more stable operating characteristics. By forming the units at the voltages at which they are to be operated, the variation of capacity which takes place when electrolytic condensers are used at much lower voltage than their rated voltages, is eliminated.

Quality Responsible for Popularity

The outstanding qualities which have been enumerated are responsible for the wide popularity of Hi-Farad condensers all over the country. They are now being used as standard equipment in the assemblies of the leading radio manufacturers and are being employed to a greater and greater extent by experimenters, radio amateurs and service men.

FREE! A copy of a 32-page book, containing a wealth of information on all types of electrolytic condensers will be sent free of charge on request. Just mail the coupon below.

Aerovox Wireless Corporation,
70 Washington Street,
Brooklyn, N. Y.

Please send me, without charge or obligation, a copy of your book, "The Hi-Farad DRY Electrolytic Condenser."

Name .....

Address .....

City ..... State .....

Measurement of Capacity and Leakage

(Continued from page 1)

especially if the condenser has not been in use for some time, but will drop quickly to a fairly low value.

A reliable leakage current reading should not be attempted until after the condenser has been connected into the D.C. circuit for at least five minutes. After five minutes the leakage as read on the A.C. milliammeter (which can be used for taking the D.C. leakage current readings) should drop to a comparatively low value of the order of .05 to .5 milliamperes per microfarad for a good condenser which has been in fairly constant use. If the leakage does not drop to such values it indicates a leaky or shorted condenser.

When the current reading has dropped to a satisfactorily low value (depending on the capacity and leakage characteristics of the condenser under test) insert plug "P" into a 110-volt A.C. outlet thus connecting A.C. voltage across the test circuit. Rheostat "R1" should then be adjusted until the voltmeter "V" reads 110 volts.

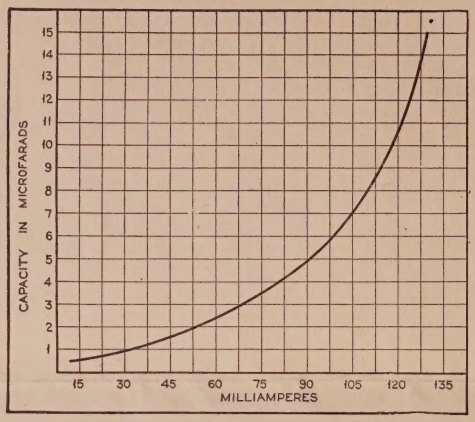


Fig. 2

The current reading of the milliammeter should then be noted. The capacity corresponding to different current readings can then be found by consulting the chart shown in Fig. 2. If the testing outfit is to be made a permanent piece of testing apparatus, an additional scale can be drawn on the milliammeter so that the regular scale can be used to read the D.C. leakage current when making D.C. leakage test and the capacity scale can be used to read the capacity direct when making the capacity test with the A.C. source.

The scale of the 0-250 milliammeter cannot of course be used to give accurate leakage measurements. If accurate leakage current data is required, a lower range 0-10 or 0-25 milliammeter should be substituted for the higher range instrument as soon as the leakage drops sufficiently to permit the use of the lower range instrument.

Care should be taken of course not to use the low range instrument when A.C. is connected across the circuit, to avoid damage to the low range meter. The circuit to the right of the dotted line A-A can be used alone when leakage current measurements alone are required.

An Important Decision on Paper Condenser Patents

THE AEROVOX WIRELESS CORPORATION
is pleased to announce that by a decision rendered February 16, 1931,
The United States Circuit Court of Appeals
For the Second Circuit
has affirmed the decree of
The United States District Court
For the Eastern District of New York
in favor of
The Aerovox Wireless Corporation
in the suit brought against it by
The Dubilier Condenser Corporation
for alleged infringement of Weiss Patent No. 1,688,478 covering the use of petrolatum in the cooling and secondary impregnation of paper condensers. The evidence in favor of the Aerovox Wireless Corporation was so conclusive that the Circuit Court of Appeals did not deem it necessary to render a written opinion.

Aerovox paper condensers are made in accordance with Aerovox Reissue Patent No. 17,605 covering the use of oil in the cooling and secondary impregnation of paper condensers.

THE AEROVOX WIRELESS CORPORATION
is pleased to renew its pledge to the industry that Aerovox prices shall never be padded with royalties on invalid or worthless patents.

New 40-page 1931 Condenser and Resistor Manual and Catalog of Aerovox Products
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